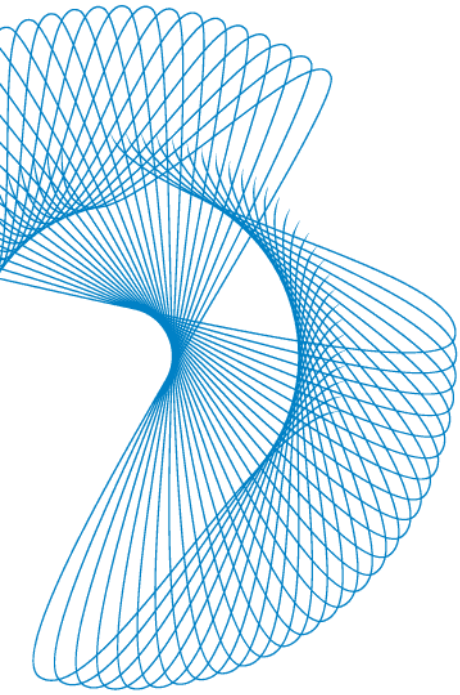
marinepollutionRESPONSEservice

MARITIME NEW ZEALAND



National Oil Spill Contingency Plan

Chapter 6 – Cleanup/Response Options for Different Environments

Contents

Overview

Spilled oil is subject to a number of processes, including spreading, evaporation, dispersion (droplets in suspension), emulsification, dissolution (very minimal), oxidation (oil combines with oxygen to dissemble into soluble products or to form persistent tars), sedimentation (sinking by sticking to sediment or organic matter), and biodegradation.

Oxidation, sedimentation and biodegradation are long-term process which determine the ultimate fate of the oil. The other processes are more important during the early stages of a spill response.

Response priorities

The response priorities are as follows:

Human safety is the overriding consideration.

- Should the nature of the spilt oil result in the production of vapour and give rise to a risk of explosion or fire, the New Zealand Fire Department should be notified immediately. Should there be any risk to life or property the Police should be advised. The Police, as well as the OSC (refer to s305 MTA) have the power to evacuate people from and prohibit entry to places at risk.

Once health and safety considerations have been taken care of the response is governed by the following principles listed in general order of priority:

Prevent spillage or stop further spillage.
Assess the incident.
Prevent spreading of spilled oil (contain, divert, or disperse).
Prevent impact of spilled oil on sensitive areas or wildlife.
Implement techniques to cleanup spilled oil, affected wildlife, and shorelines.

Response options

The actual response option(s) will depend on the incident, the nature of the oil, the location of the spill, the sensitivity of the area, and the weather and sea conditions. The potential response options are expanded upon below.

The response options selected should aim to:

- prevent spillage or stop further spillage;
- prevent spreading (booms);
- enhance evaporation (via agitation);
- enhance dispersion (via agitation, dispersant);
- prevent emulsification (via removal prior to emulsification, dispersant); and
- remove oil from the environment where practicable.

Prevent spillage or stop further spillage

This option is only applicable to spills that are either ongoing spills or spills that have not yet occurred, but may occur. An example of the former is oil leaking from a sunken vessel or a fractured pipeline and an example of the latter is a grounded ship or a ship otherwise in distress.

Particular options include, but are not limited to, the following:

- fuel salvage,
- vessel salvage,
- blocking source,
- blocking breather pipes,
- patching holes,
- shutting off pumping equipment,
- shutting off valves to isolate leaking areas,
- transferring oil or shifting source,
- making vessel or facility operators aware of the spill,
- preventative booming, and
- places of refuge (see Chapter 13).

Where salvage of either oil or the vessel is proposed, it is important to ensure that the salvage operation will not result in more spillage than what would have occurred otherwise. The salvor should be requested to supply a salvage plan which should be referred to the salvage advisor. Maritime NZ can access salvage expertise and as such should be consulted.

Assess the incident

The monitoring and assessment of any spill event is critical to ensure that appropriate response decisions are made. The type of information required will include:

- the type and quantity of oil,
- its location and predicted movement,
- how the oil might weather, and
- any other relevant information.

The Marine Oil Spill Assessment Form (Chapter 2) should be used to record this information. For guidance on monitoring oil spills refer to the “Oil Spill Monitoring Handbook”.

Prevent spilled oil from spreading (contain, divert, or disperse)

This option is applicable to any spilled oil whether it is from a single event spill or one of an ongoing nature. Particular options include, but are not limited to, the following:

- contain spilled oil with booms or other floating barriers for later recovery by skimmer, sorbents or sucker truck;
- divert (deflect) spilled oil away from highly sensitive areas;
- apply dispersants to disperse the oil into the water column (see “Oil Spill Dispersants – Guidelines for Use in New Zealand”); and
- enhance natural evaporation of the spilled oil.

Prevent impact of spilled oil on sensitive facilities, craft, or wildlife

This option is applicable to any spilled oil whether it is from a single event spill or one of an ongoing nature. In some instances it will be easier, less costly, more practicable and more effective to minimise damage by keeping facilities, craft or wildlife that are sensitive to damage from the spilled oil away from the spillage.

Particular options include, but are not limited to, the following:

discouraging birds or animals from landing, wading or feeding on areas of water or foreshore affected or potentially affected by spilled oil;
removing boats and other vessels that may have their hulls fouled;
preventing use of waters or foreshore affected by spilled oil; and

- pre-cleaning of potentially impacted beaches.

Implement techniques to clean up spilled oil

As well as efforts preventing or reducing the quantity of oil spilled and minimising its impact on the environment it may be necessary to remove the oil from the water's surface or from impacted shorelines. Any oil that neither evaporates or disperses into the water column will remain afloat or wash ashore and will need to be physically cleaned up, recovered or left to breakdown naturally. Any recovery of spilled oil will necessitate some form of storage/disposal whether that be temporary or permanent – see Chapter 11.

Clean up options in this wider sense include the following:

- remove from the water using skimmers;
- remove from the water using sorbents (pads, pillows, booms);
- remove from the water using a rope mop;
- remove from the water using a suction truck;
- remove from the shore using water, shovels, graders, excavators, sorbents and manpower depending on the physical environment (see Shoreline Cleanup Guides below);
- treat oiled wildlife; and
- leave the spilled oil alone and allow it to biodegrade and bioremediate.

Preferred response options

The regional oil spill contingency plan contains information regarding preferred response options for areas that are a priority for protection. Other information on how particularly sensitive environments should be cleaned are listed in Annex 4 of the Regional Plans.

Response techniques

There are many references which discuss the available techniques in some detail. These include Maritime NZ's Marine Oil Spill Management Resource Manual. Additional references are listed at the end of this chapter. For all responses consideration of the behaviour of oil, the nature of the environment and the use of a 'decision guide' on cleanup response will help determine the appropriateness of each technique.

- Monitor and evaluate (Natural Recovery).
- Dispersants.
- Contain and recover.
- Protection.
- Foreshore cleanup.
- In-situ burning.
- Bioremediation.

Inside the 200nm limit all of the above response options for oil spill cleanup may be considered. For oil spills outside the 200nm limit the most appropriate response would probably be to monitor the slick, with the possibility of carrying out dispersant operations.

The impact that the cleanup process will have on the environment relative to the damage caused by stranded oil should be a consideration when deciding upon the appropriate response. Net Environmental Benefit Analysis (NEBA) should be used.

Monitor and evaluate

This option is particularly suitable for non-persistent oils that are not threatening sensitive areas. Such oils will generally disperse naturally within a day or so. Agitation may assist evaporation/dispersal. The option may also be suitable for more persistent oils that don't threaten any sensitive shoreline or wildlife. If conditions are such that the oil will be carried offshore, the oil will eventually disperse naturally, although over a longer period than non-persistent oils.

Any decision to allow persistent oils to biodegrade once they have impacted on a shoreline will be made in consultation with the wildlife advisor and only after having had regard to the following matters:

- the quantity and type of oil;
- the shoreline topography and substrate;
- the ecological values of the shoreline;
- the recreational use of the area;
- the wave climate;
- the safety of responders;
- the potential long term impacts of the spilled oil on the foreshore, sub-tidal areas, and neighbouring land; and
- the potential adverse effects of the clean up methods or activities.

Equipment for cleanup operations

Annex 1 lists the oil spill cleanup equipment that is available for use during a spill response, both from within New Zealand and from overseas.

Oil-Specific Response Options

Petrol and Jet A1

Prevent further spillage. Contact Fire Department who will secure the site. Once it is safe to do so (Fire Service recommendation) residuals could be removed by absorbents if required to avoid adverse effects on the environment. Dispersants should not be used.

Automotive gas oil (Diesel)

Prevent further spillage. Proceed if safe to do so (OSC decision). Contain if possible using quick response sorbent booms. For small-localised spills: If possible remove from the water with absorbents, or agitate to enhance dispersion. For larger spills, the same procedure could be used in conjunction with booms (where appropriate) to protect any threatened sensitive areas, skimmers to recover any collected oil, and hazing of wildlife if appropriate.

Dispersant use is very seldom appropriate on diesel, although exceptions may arise where human health is directly at risk from fire or fumes. It should only be considered if:

- containment and/or physical removal will not be sufficient, appropriate or possible; and evaporation and natural or agitated dispersion is not occurring sufficiently fast to avoid adverse effects on the environment;
- there is a clear net environmental benefit from use of dispersant.

Light fuel oil

Prevent further spillage. Proceed if safe to do so (OSC decision). Contain if possible using quick response sorbent booms. For small-localised spills: If possible remove from the water with absorbents, or agitate to enhance dispersion. For larger spills: Contain if possible by booming, or direct to recovery area, and remove from the water with skimmers, rope mops, suction pumps or absorbents. Booms could be used (where appropriate) to protect any threatened sensitive areas, along with hazing of wildlife if appropriate.

Dispersant use should be considered in circumstances where:

- containment and/or physical removal will not be sufficient, appropriate or possible; and evaporation or natural or agitated dispersion is not occurring sufficiently fast to avoid adverse effects on the environment;
- the dispersant will work on the particular type of oil spilled; and
- there will be net environmental benefit from use of dispersant.

Heavy fuel oil

Prevent further spillage. Proceed if safe to do so (OSC decision). Contain if possible using booms. For small-localised spills: If possible remove from the water with absorbents or skimming devices. For larger spills: Contain if possible by booming, or direct to recovery area, and remove from the water with skimmers, rope mops, suction pumps or absorbents. Booms could be used (where appropriate) to protect any threatened sensitive areas, along with hazing of wildlife if appropriate.

Dispersant use should be considered in circumstances where:

- containment and/or physical removal will not be sufficient, appropriate or possible; and/or
- natural or agitated dispersion is not occurring sufficiently fast to avoid adverse effects on the environment;
- the dispersant will work on the particular type of oil spilled; and
- there will be net environmental benefit from use of dispersant.

Crude oils

Prevent further spillage. Proceed if safe to do so (OSC decision). Contain if possible using booms. For small-localised spills: If possible remove from the water with absorbents or skimming devices. For larger spills: Contain if possible by booming, or direct to recovery area, and remove from the water with skimmers, rope mops, suction pumps or absorbents. Booms could be used (where appropriate) to protect any threatened sensitive areas, along with hazing of wildlife if appropriate.

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- natural or agitated dispersion is not occurring sufficiently fast to avoid adverse effects on the environment;
- the dispersant will work on the particular type of oil spilled; and
- there will be net environmental benefit from use of dispersant.

Situation Evaluation and Selection of Response Options

STEP	ACTION	DETAILS
1	Collect incident details	
2	Stop or reduce further spillage of oil	For ship spills: 1. Master of ship to identify damaged tanks; 2. Consider moving damaged ship to shelter/place of refuge; and 3. If possible transfer oil in damaged tanks to any space available within ship or transfer some/all of oil to another ship. Note: If damaged ship aground, use shallow draught barge or floating storage tank or floating hoses to transfer the oil to a ship in deeper water For other sources of spills, refer to tier 1 plan details.
3	Aerial surveillance of oil slick	Information from aerial surveillance of the slick is of vital importance in choosing response options. Use fixed wing aircraft or helicopter with appropriate navigational aids and communications equipment. Aerial surveillance provides information about: • the size, quantity and location of the spill; • the movement of the oil; • changes in the appearance and distribution of the oil over time; • marine and coastal resources or areas or under threat; and the effectiveness of response options.
4	Assess threat of oil slick	Information about an oil spill is assessed before deciding appropriate response actions. Factors to consider include: • size of the spill; • the likelihood of further spills; • type(s) of oil; • weather, including wind direction and force, sea state, sea temperature and tide current; • position of the spill in relation to marine and coastal resources; and likely movement of the spill.
5	Select spill response options	**No action other than monitoring** Preferred option if the slick is not moving shoreward, no important resources are threatened, the oil is breaking up naturally, and/or conditions are such that positive response options are not practicable. Containing or recovering the oil at sea Often the preferred option for both environmental and socio-economic reasons. **Chemical dispersion at sea** To enhance the dispersion of oil from the surface into the water column by the application of dispersant chemicals. **Shore-line cleanup** When it is likely that some oil will or has come ashore and shore-line clean-up will be necessary. The decision to clean the affected shore-line depends on: • the impact of stranded oil on all aspects of the environment, • the impact of stranded oil on commercial activities, • the possibility that stranded oil might re-contaminate another part of the shoreline, and • the feasibility of clean-up operations. **Combination of response options** Usually needed in a large spill.

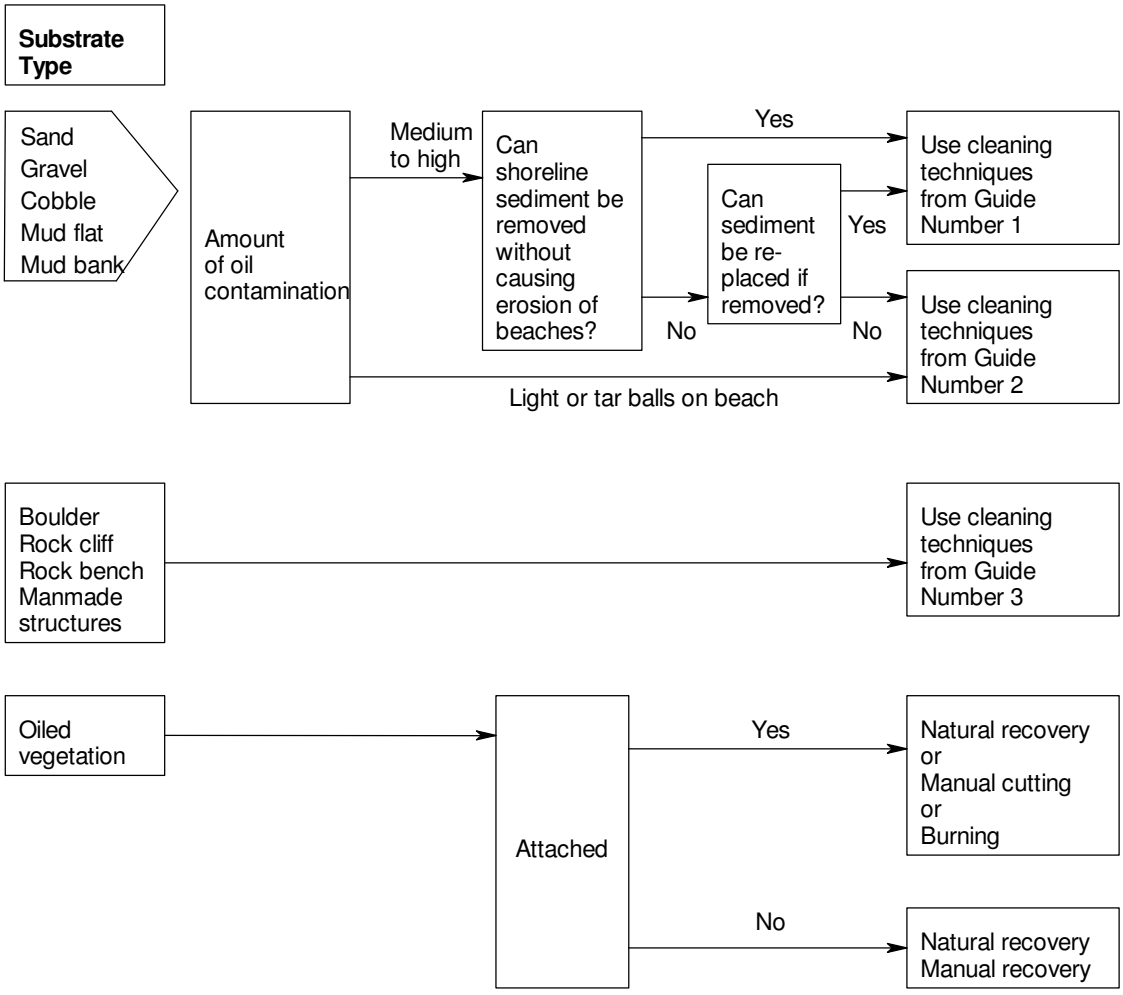
Cleanup Techniques for Environmentally Sensitive Areas

HABITAT TYPE	CLEANUP TECHNIQUES			
	PREFERRED	VIABLE	NOT ADVISABLE	AVOID
Salt marshes	Boom and skim. Low-pressure flushing. Enhance drainage. Natural recovery.	Dispersants. Sorbents. Bioremediation.	Manual cutting.	Burning. High-pressure flushing. Manual removal. Sinking agents. Substrate removal.
Soft bottom inter-tidal habitat	Natural recovery.	Manual removal.	Substrate removal. Vacuum/pumping.	Sinking agents.
Rocky inter-tidal kelp beds	Natural recovery.	boom and skim low-pressure flushing sorbents manual cutting dispersants	High-pressure flushing. Vacuum/pumping.	Burning. Sinking agents.
Inter-tidal seagrass bed	Low-pressure flushing. Bioremediation. Dispersants.	Low-pressure flushing. Bioremediation. Dispersants.	Manual removal. Sorbents.	Sinking agents. Substrate removal. High-pressure flushing. Vacuum/pumping. Manual cutting.
Mangrove forest	Boom and skim Low-pressure flushing. Enhance drainage.	Sorbents. Natural recovery. Manual removal. Vacuum/pumping. Dispersants.	High-pressure flushing.	Burning. Sinking agents. Substrate removal.
Coral lagoons	Boom and skim. Natural recovery. Vacuum/pumping.	Manual removal. Sorbents.	Dispersants.	Burning. Sinking agents.
Coral reefs	Natural recovery.	Dispersants. Low-pressure flushing. Vacuum/pumping.	Sorbents.	Burning. Sinking agents.

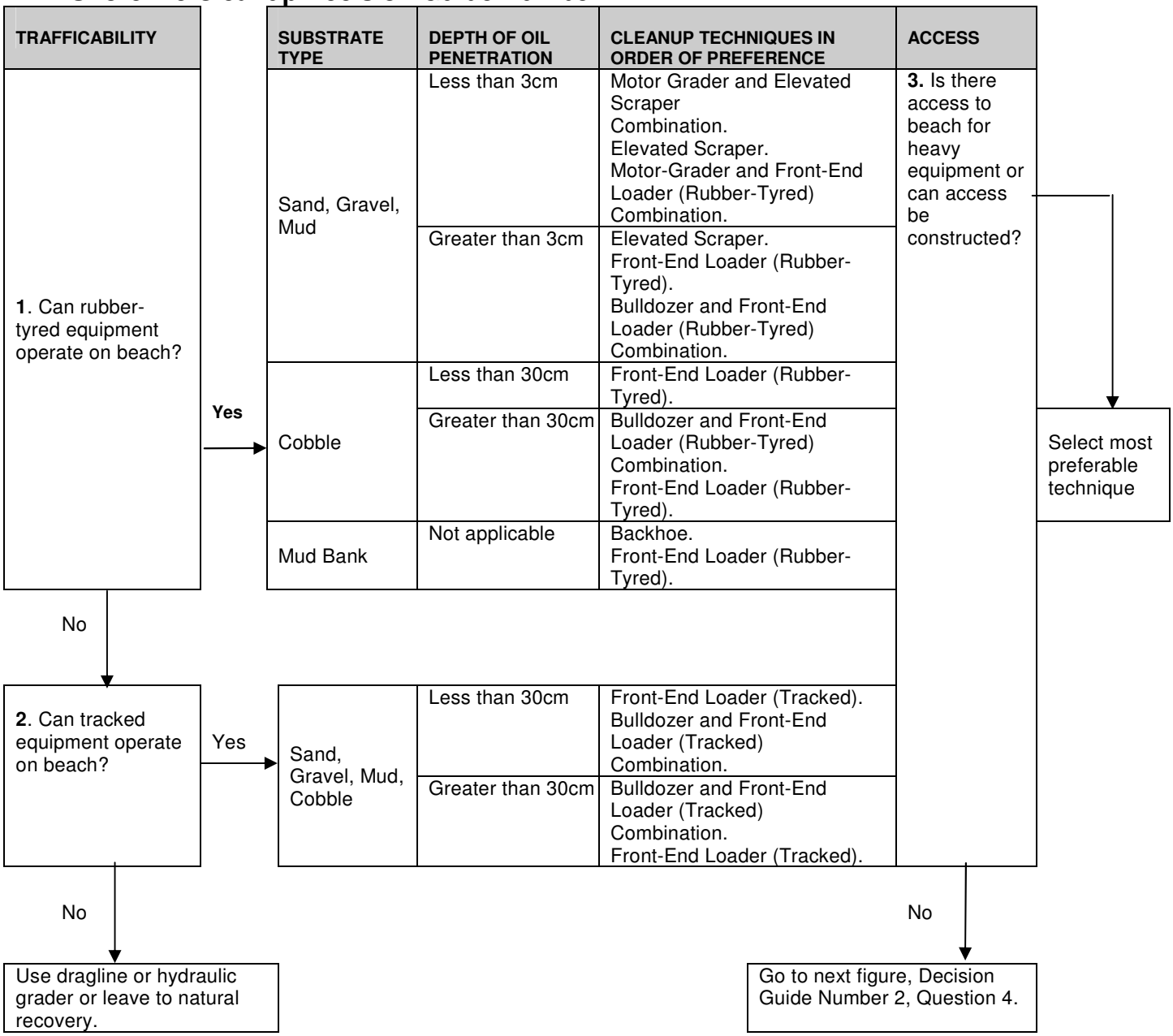
Shoreline Cleanup Decision Guides

Key to Shoreline Cleanup Decision Guides

It is first desirable to have a consensus of the monitoring agencies on the character of the shoreline and the nature of oil conditions. Once these are agreed upon, a process is necessary to determine the proper treatment required. The following figures contain decision guides for selecting the most appropriate cleanup technique. Below is a key where substrate and level of oil contamination lead to one of the three following guides. These three guides direct the user to one or more cleanup techniques applicable to the specific situation with the most preferable technique listed first. If the first technique cannot be used because of the lack of equipment or access to the shoreline, then the next technique should be chosen.



Shoreline Cleanup Decision Guide Number 1



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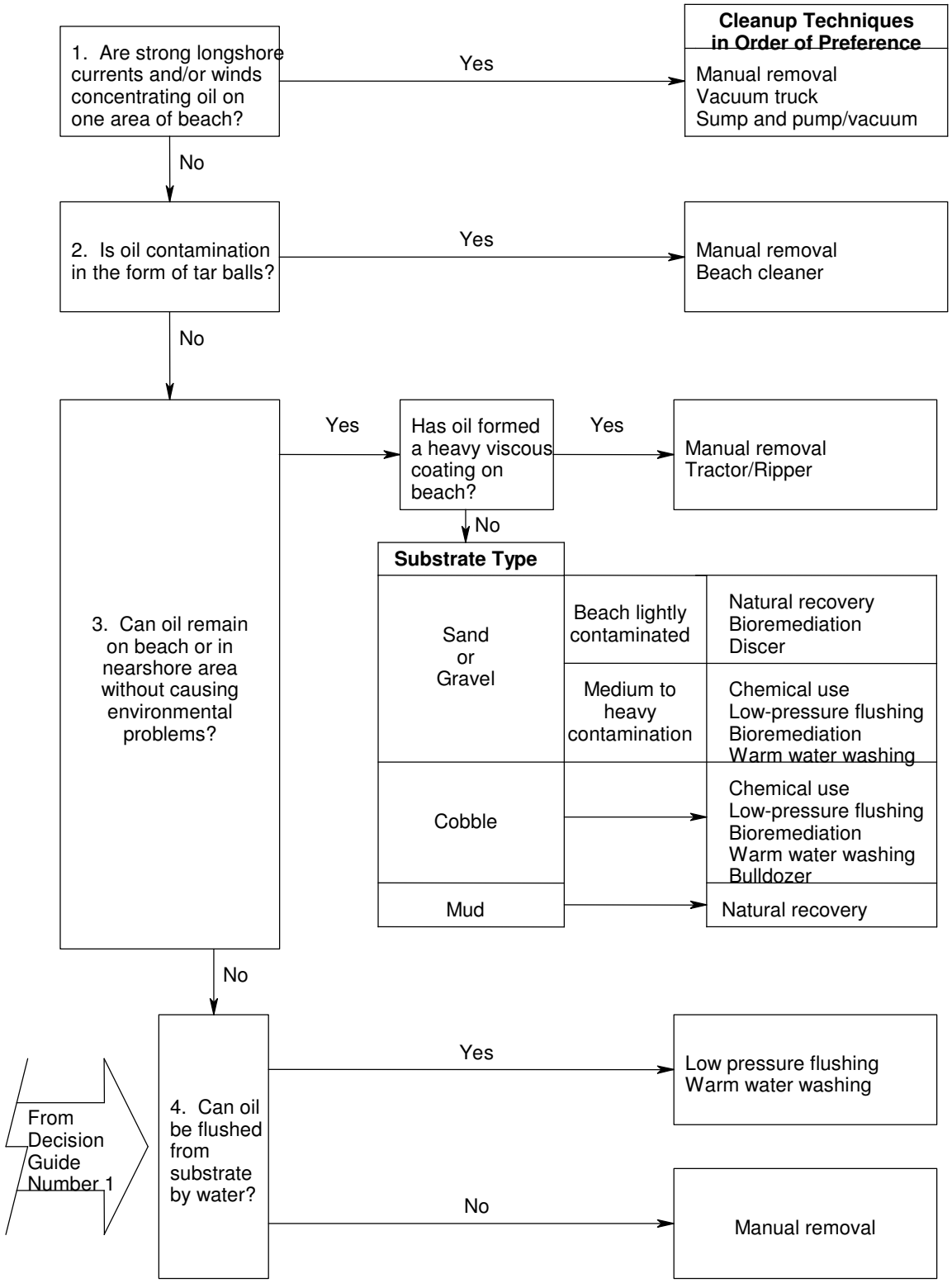

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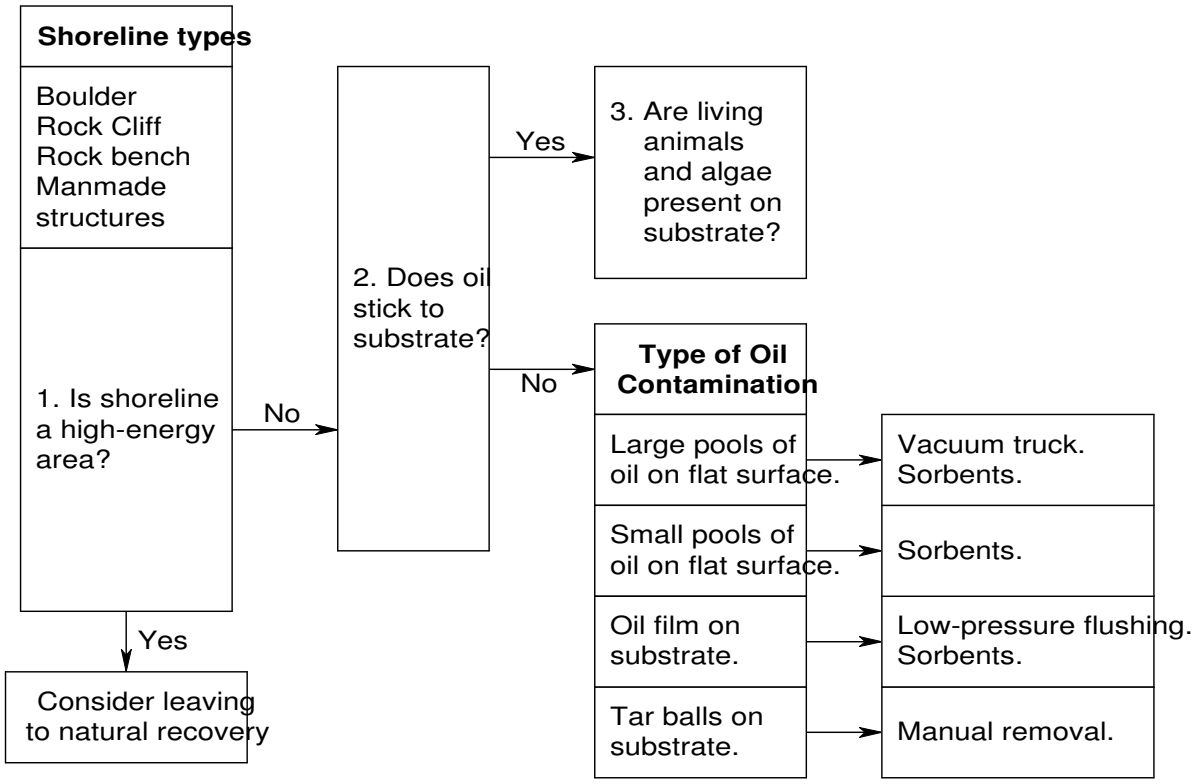

Persistence, Recoverability, and Dispersability

The following table indicates persistence, methods of recovery, and dispersability of oil that may be spilled in New Zealand. Note that the table does not indicate the preferred response.

FUEL TYPE	PERSISTENCE	RECOVERABILITY IN WATER	DISPERSABILITY
Petrol (91,96)	0 - 1 day, may be few hours only.	Sorbent materials only	Not suitable
Jet A1	0 - 1 day	Sorbent materials only	Not suitable
Automotive Gas Oil	2 days maximum, approximately 2/3 gone in 18 hours	Sorbent materials only	Dispersible with: Gamlen OSD LT, Shell Concentrate VDC, Corexit 9527, Tergo R40 at temperatures greater than 7o Celsius
Light fuel oil	1 - 4 days	Booms with skimmers / rope mops / suction pumps, or sorbent materials	Needs to be tested using Dispersant Test Kit and field trials (sea and/or air as applicable).
Heavy fuel oil	Weeks to months	Booms with skimmers / rope mops / suction pumps, or sorbent materials	Needs to be tested using Dispersant Test Kit and field trials (sea and/or air as applicable).
Bitumen	Indefinitely	Nets / collection off beaches	Not practicable
Crude	1 - 2 weeks	Booms with skimmers / rope mops / suction pumps, or sorbent materials	Needs to be tested using Dispersant Test Kit and field trials (sea and/or air as applicable).

Skimmer selection matrix

		SKIMMER TYPE								
		WEIR SKIMMERS		OLEOPHILLIC SKIMMERS			MECHANICAL		INCLINED PLANE	
		Passive Weir (Mini-max, Global Spil, Foilexl)	Terminator	Disc (Komara, Aquaguard Disc)	Rope Mop	Ro-Disc (Terminator Cassette)	Brush (Aquaguard)	Brush (Terminator Cassette)	DIP 400 on Oil Recovery Vessel	DIP 400 on Vessel of Opportunity
Operating Environment	Rough Water	X	X	—	✔	—	X	X	X	X
	Protected Water	—	—	✔	✔	—	—	—	—	—
	Calm Water	✔	✔	✔	✔	✔	✔	✔	✔	✔
	High Current > 1 knot (0.5m/s)	X	—	X	—	—	—	—	✔	✔
	Debris	X	✔	X	✔	X	X	X	X	X
Oil Viscosity3	High Viscosity	X	—	X	X	X	✔	✔	— 1	—1
	Medium Viscosity	✔	✔	✔	✔	✔	—	—	✔	✔
	Low Viscosity	—	—	—	—	—	X	X	✔	✔
Oil Thickness	< 5mm	X	X	✔	✔	✔	X	X	—	—
	> 5 mm	✔	✔	✔	✔	✔	✔	✔	✔	✔
Skimmer Characteristics	% Oil in recovered product	X	X	✔	✔	✔	—	✔	✔ 2	✔ 2
	Recovery Rate (Pumping capacity)	—	✔	—	X	✔	X	✔	—	—
	Ease of deployment	✔	—	✔	—	—	✔	—	✔	—

Key: Good ✔ Fair — Poor X

Notes:

1. The Sip 400 system can be enhanced by the use of the GTA 20 pumps if handling high viscosity oils.
2. If using the GTA 20 pumps a higher percentage of water will be collected.
3. High viscosity = Heavy fuel/Weathered crude.
   Medium viscosity = Fresh crude.
   Low viscosity = Light oils, Diesel, etc.

Boom selection matrix

		BOOM TYPE				
		Fence Boom - Includes Harbour Boom and Coastal Boom	Land/Sea Boom	Includes Rapid Deployment Boom and Slickbar Boom	Ro-Boom	Troilboom
Operating Environment	Rough Water	X	X	X	—	—
	Protected Water	—	✔	—	✔	✔
	Calm Water	✔	✔	✔	✔	✔
	Strong wind	X	✔	—	✔	✔
Performance	Ease of deployment	✔	—	✔	—	—
	Wave following	X	✔	X	✔	—
	Shoresealing	X	✔	X	X	X
	Towable Containment	—	—	X	✔	✔
Physical	Strength / Robustness	✔	—	—	✔	✔
	Buoyancy	X	✔	—	✔	—
	Shallow water < 1m	X	✔	✔	X	X
	Section length	20m / 25m	20m	33m / 66m	200m	?

Key: Good ✔ Fair — Poor X